SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 – GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of the dry type general-purpose transformers.

1.2 RELATED WORK

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of nonstructural components.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.

D. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, impedance, dimensions, weight, mounting details, decibel rating, terminations, temperature rise, no load and full load losses, and connection diagrams.
3. Complete nameplate data including manufacturer’s name and catalog number.

C. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.
2. If changes have been made to the originally submitted maintenance and operating manuals, then two weeks prior to final inspection submit

four copies of updated maintenance and operating manuals to the Contracting Officer's Representative (COR).

D. Certifications: Two weeks prior to the final inspection, submit four copies of the following to the COR:
   1. Certification by the manufacturer that the transformers conform to the requirements of the drawings and specifications.
   2. Certification that the equipment has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Fire Protection Association (NFPA):
   70-05.....National Electrical Code (NEC)

C. National Electrical Manufacturers Association (NEMA):
   ST 20-97.....Dry-Type Transformers for General Applications

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE DRY TYPE TRANSFORMERS

A. Unless otherwise specified, dry type transformers shall be in accordance with NEMA, NEC and as shown on the drawings. Transformers shall be UL listed or labeled.

B. Dry type transformers shall have the following features:
   1. Self-cooled by natural convection, isolating windings, indoor, dry type. Autotransformers will not be accepted.
   2. Rating and winding connections shall be as shown on the drawings.
   3. Transformers shall have copper windings.
   4. Ratings shown on the drawings are for continuous-duty without the use of cooling fans.
   5. Insulation systems:
      a. Transformers 30 KVA and larger: UL rated 220 degrees C system having an average maximum rise by resistance of 150 degrees C in a maximum ambient of 40 degrees C.
      b. Transformers below 30 KVA: Same as for 30 KVA and larger or UL rated 185 degrees C system having an average maximum rise by resistance of 115 degrees C in a maximum ambient of 40 degrees C.
   6. Core and coil assemblies:
      a. Rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipment.
      b. Cores shall be grain oriented, non-aging, and silicon steel.

c. Coils shall be continuous windings without splices except for taps.
d. Coil loss and core loss shall be minimum for efficient operation.
e. Primary and secondary tap connections shall be brazed or pressure type.
f. Coil windings shall have end fillers or tie downs for maximum strength.

7. Certified sound levels determined in accordance with NEMA, shall not exceed the following:

Transformer Rating	Sound Level Rating
0 - 9 KVA	40 dB
10 - 50 KVA	45 dB
51 - 150 KVA	50 dB
151 - 300 KVA	55 dB
301 - 500 KVA	60 dB

8. Nominal impedance shall be as shown on the drawings. If not shown on drawings, nominal impedance shall be as permitted by NEMA.
9. Single phase transformers rated 15 KVA through 25 KVA shall have two, 5 percent full capacity taps below normal rated primary voltage. All transformers rated 30 KVA and larger shall have two, 2-1/2 percent full capacity taps above, and four, 2-1/2 percent full capacity taps below normal rated primary voltage.
10. Core assemblies shall be grounded to their enclosures by adequate flexible ground straps.
11. Enclosures:
    a. Not less than code gage steel.
    b. Outdoor enclosures shall be NEMA 3R.
    c. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
    d. Ventilation openings shall prevent accidental access to live components.
    e. Thoroughly clean and paint enclosure at the factory with manufacturer's prime coat and standard finish.

12. Standard NEMA features and accessories including ground pad, lifting provisions and nameplate with the wiring diagram and sound level indicated on it.
13. Dimensions and configurations shall conform to the spaces designated for their installations.
14. Transformers shall meet the minimum energy efficiency values per NEMA TP1 as listed below:

kVA Rating	Output efficiency (%)
15	97
30	97.5
45	97.7
75	98
112.5	98.2
150	98.3
225	98.5
300	98.6
500	98.7
750	98.8

2.2 NONLINEAR TRANSFORMERS

A. Transformers shall be designed to withstand the overheating effects caused by harmonics resulting from non-linear (non-sinusoidal) loads such as office equipment using solid-state switching power supplies (i.e. computers, laser printers and copiers).
B. Copper coils' neutrals shall carry at least 200% of normal phase current.
C. Minimum efficiency designed to supply circuits with a harmonic profile equal to or less than a K factor of 13 without exceeding specified temperature rise. Transformers with K factor of 13 shall be provided, if K factor is not shown on contract drawings. Table below applies to K-13 transformers only.

Harmonic		K-13 (%)
Fundamental		100
3rd		70
5th		42
7th		5
9th		3
11th		3
13th		1
15th		0.7

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of transformers shall be in accordance with the NEC, as recommended by the equipment manufacturer and as shown on the drawings.

B. Install the transformers with adequate clearance at a minimum of 100 mm (4 inches) from wall and adjacent equipment for air circulation to remove the heat produced by transformers.

C. Install transformers on vibration pads designed to suppress transformer noise and vibrations.

D. Use flexible metal conduit to enclose the conductors from the transformer to the raceway systems.

3.2 SPARE PARTS

A. Deliver the following spare parts for the project to the - COR two weeks prior to final inspection:

1. Six stand-off insulators.
2. Six insulated protective caps.
3. One spare set of high voltage fuses for each size fuse used in the project.

3.3 TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems. Refer to Section 01 00 00 GENERAL REQUIREMENTS.

1. Train Owner's management and maintenance personnel in interpreting and using monitoring displays and in configuring and using software and reports. Include troubleshooting, servicing, adjusting, and maintaining equipment. Provide a minimum of 8 hours' training.

2. Training Aid: Use approved final versions of software and maintenance manuals as training aids.
3. Test and troubleshoot the system.

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